

**CONTRIBUTION TO AN OPEN PROBLEM OF HARKNESS AND  
SHANTARAM, THE LIMIT OF FAMILIES OBTAINED BY THE  
STATIONARY EXCESS OPERATOR**

In 1969, Harkness and Shantaram [1] obtained, under sufficient conditions, a limit theorem in law for sequences of nonnegative random variables build with the iterated stationary excess operator and raised a problem or identification of the distribution of the limit. We give a complete answer to their problem through the convergence of families build by the continuous time version of the iterated stationary excess operator and also by size biasing. In this context, we show that (i) the conditions of Harkness and Shantaram are actually necessary, (ii) continuous time convergence is equivalent to discrete time convergence and (iii) the only possible limits in distribution are mixture of exponential with log-normal distributions.

[1] Harkness, W. L., Shantaram, R.: Convergence of a sequence of transformations of distribution functions. *Pacific Journal of Mathematics*, 31(2), 1969.